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solplan review

the independent newsletter of energy conservation, building science & construction practice

Inside. . . .

The mountains of waste we create are becoming everynone's concern. If someone isn't concerned, the full garbage dumps will force them to look at alternatives. We report on work by the Toronto home builders to come to grips with construction waste management.

Concern for the environment also means that more people understand the importance of using products that are not going to make the situation worse. The Environmental Choice program was started to assist in making informed purchasing decisions. We list the first products that have received certification.

How airtight are new houses? How important is it to know? We present the findings of a recent study.

Ventilation systems must be quiet if they are to be used. We present a case study of a system in North Vancouver.

How much can be done to resist earthquakes is difficult to predict. We report on findings of a study team that travelled to San Francisco after the October quake.

Other items include a report on the advanced house recently completed in Toronto, the 1989 Job Site innovator award, report on gas fireplace certification, report on a new mechanical system component, and more.

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Construction Waste

From the Publisher

In their Housing Quality position paper CHBA defines quality to include higher value, better performance, and suitability of homes and communities for their intended market.

I don't think anyone would seriously argue with that. Unfortunately, translating it into reality is another thing. Too often quality is equated with expensive hardware and finishes - the surface things that put a sheen on the project, and not the important elements beneath the surface.

A gold plated doorknob or tap doesn't add much to the quality - they both do the job equally well, but one is perceived to improve the quality over the other (and too often is promoted as such). The same can be said about other fixtures and finishes in the house.

If one looks closely quality is visible. Recently I have gone through several display homes that were obviously meant to be "quality" products. What was on show? In a word: shoddy construction. There seemed to be little attention paid to detail. Granted, I may be looking more critically than the average person. But when the homeowner starts furnishing the house and finds that floors are not level or rooms are not square (when they're supposed to be) it stands out like a sore thumb.

Is it good quality if foundation walls are not plumb? Or a ventilation system has cheap pressed metal grilles located on prominent wall locations (right position but wrong type of fitting)? What about joists that have been cut in mid-span, making them useless (not to say dangerous) just because some equipment had to be installed? Or drafts due to ill fitting doors and windows? Or a heating system that's not laid out properly? Quality is more than skin deep. It is a part of the whole, from the ground up.

Where is the pride in workmanship? Just because times are good and everyone is busy does it justify lowering quality standards and tolerating sloppy work?

Attention to the surface features, and not what's under the hood, caused problems for the North American auto industry. We've reached the point that quality automobiles are associated only with product made in Europe or Japan. The same applies to electronics, appliances, and many other products.

Fortunately, housing is not quite as portable (yet). Unless we pay attention to quality issues below the surface, then even housing is going to suffer, as more foreign technology is introduced.

R Kadulski
Richard Kadulski
Publisher

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Editor-Publisher: Richard Kadulski
Illustrations: Terry Lyster

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Making a Molehill Out of a Mountain: waste management in construction

Construction generates large quantities of garbage. In major cities waste handling and processing is fast becoming a crisis. In the Toronto area existing landfill sites will be full and closed by 1992. In some areas of the U.S. dumping fees run into many hundreds of dollars per container. Much of the garbage the residential construction industry produces now is destined for landfill sites, but landfill can no longer be considered as the answer for everything.

Bans on disposal of waste products such as white goods and cardboard have already altered the way many builders work. Upcoming bans on wood products and drywall will have a direct impact on renovators and builders as these products are among their principal wastes.

The Toronto Home Builders Association (THBA) undertook a study to examine the scope of the landfill crisis within the Toronto area; to examine the state of the waste management among renovators and new home builders; and to explore alternative ways of dealing with construction and demolition wastes.

While the report dealt with Toronto, the situation is not much different in other areas. If we are to be environmentally responsible to our community and to our children, we must come to grips with the issue and stop producing as much garbage as we are. There are lessons to be learned by all of us.

The THBA report represents a proactive initiative to help the industry understand the scope of, and find a solution to, the growing waste management problem.

How is the waste generated?

Renovators and new home builders produce (both by volume and weight), about 16% of all landfill wastes; new home builders' share of the overall total is 2-3%. Although this may not seem like a lot, total waste management expenditures for THBA renovators and new home builders is over $50 million a year. This figure has nowhere to go but up unless other waste management practices are developed.

Alternative waste management systems will have to find new methods for reducing, reusing and recycling the wastes being produced.

The builder survey showed that while 65% considered waste disposal a concern, less than 50% were able to give detailed figures for their own waste expenditures. (The average was $ 300 per house). The amount of waste produced averages more than 2.5 tonnes per house.

To develop good waste management practices it is necessary to know how much is produced. The amount will vary from builder to builder.

Table 1 shows the kinds and quantities of waste are generated. It is based on a survey of a number of construction sites.

TABLE 1

dimensional lumber (0.84 tonne)	25%
manufactured wood (0.42 tonne)	10%
drywall	15%
masonry and tile (1.0 tonne)	12%
corrugated cardboard (0.066 tonne)	10%
asphalt	6%
metal wastes	4%
plastic and foam	4%
fibreglass	5%
packing materials	4%
other wastes	5%

Lumber

Dimensional lumber and manufactured wood product wastes account for about 35% of all on-site garbage. This is equivalent to about 200 2 x 4 studs per house, or as much as 10% of all the lumber purchased for construction. Manufactured wood (chipboard, plywood, etc.) is less of a problem, but still accounts for over one quarter of wood wastes, averaging .424 tonnes per house.

Alternatives suggested by builders to reduce this waste include reusing wood off-cuts (e.g. re-cutting as bridging) and use of off-site manufactured wall-framing components.

Some builders would like to see the responsibility for wood waste management shifted to framing contractors in the same way that drywall is handled on most sites. This may not solve the disposal problem, but it might result in more thought on site resulting in reduced wastage.

Drywall

Estimates of drywall wastes on construction sites vary widely. New Westminster Gypsum, a company that recycles drywall, estimates one pound of drywall waste per square foot of finished floor area or - about 2,500 pounds per house. Drywall contractors estimate it is between 10-12 sheets per house (500 to 600 pounds). Site observations estimated drywall is about 15% of the total volume of construction garbage headed for landfill (an average weight of 400 kg or 880 lbs).

Shifting responsibility for disposal of drywall to the contractor hasn't solved the problem but it may have reduced the amount produced as the people working with the drywall are more conscious of the waste and make more efficient use of the material.

Recycling facilities are now being built to handle drywall. New Westminster Gypsum in Langley B.C. is currently operating a drywall recycling facility that accepts drywall waste from the Greater Vancouver Area. The company is building a similar facility in Oakville which will draw from throughout the Toronto area. Waste drywall is separated into its gypsum and paper components, and the gypsum reused for drywall.

Masonry and Tile

Masonry and Tile accounts for about 12% of the total volume of on-site waste. For an average house one tonne of masonry and tile products is wasted (primarily brick), which is the equivalent of 400 standard bricks.It doesn't often end up in the garbage bin and is not destined for landfill. But it is used for fill on site as backfilling is allowed under the building code as long as materials used won't degrade and create structural problems. However, brick is an expensive fill and reduction or reuse would be a more economical alternative.

Corrugated Cardboard

Corrugated cardboard is already under partial ban at most landfill sites in Southern Ontario and most builders are actively separating it from other waste. It accounts for approximately 10% of garbage, by volume, or roughly 66 kg. per house (it is recycled).

Asphalt

(shingles, roofing paper, etc.)

Asphalt products amount to roughly 6% of the total volume of wastes, mostly asphalt shingles. As with bricks, the number of undamaged shingles found on many sites suggests that there should be ways of reducing the amount wasted.

Metal, Plastics and Foam, Fibreglass, and other Packaging

Each of these accounts for approximately 4% of the total volume of wastes. Separating these waste products on-site is costly and time consuming. It's uncertain what pressures the industry could bring to bear on manufacturers, but many builders commented on the over-packaging of many of the materials being brought onto the site.

Other Wastes

Non construction-related wastes can represent as much as 5% of the total volume of wastes accumulated in bins located on construction sites. The majority is comprised of garbage that other people (the midnight marauders) toss into construction bins.

The variation in the amount of garbage being produced from site to site suggests that there is much room to reduce their wastage. Most waste management practices which builders might implement require some on site-separation. If this process is to be effective, there will have to be a general shift in attitudes (or high dumping fees will force these on the builder).

An interesting observation made was that high-end projects (homes over $800,000) often produce less garbage than projects involving average cost homes.

Renovations

The situation for renovators is different than that of new-home builders, as most of the garbage is generated during the demolition process. Average annual waste disposal costs for Toronto area renovators are just under $40,000 per year. Renovators also have space limitations which make it difficult to implement efficient site separation.

Reuse is one of the key elements of waste management. Renovators could benefit by implementing reuse strategies. The number of reusable items varies from project to project but they can be impressive. A survey of 100 companies produced the following number of reusable products in a year:

711 Kitchen Sinks
455 Bathtubs
510 Refrigerators
3277 Interior Doors
2611 Exterior Windows

Unfortunately a majority of these items are damaged or destroyed in the demolition process. For recycling to be an option, a system of site-stripping up-front has to be implemented.

There is a potential for using some items for disaster relief and emergency housing, as well as for resale as used goods or for a refurbishing industry to recondition these products.

Demolition contractors often receive a set fee for a project, out of which they must pay for hauling and tipping fees. Demolition teams have an incentive to minimize their costs, and many have become efficient at stripping various types of wastes.

Perhaps due to the customized nature of their work, renovators appear to be more efficient than new home builders, producing fewer wastes per square foot of new construction.

Where is this leading?

The Province of Ontario has a policy calling for a 25% reduction in waste from all sectors of the economy by 1992, and a 50% reduction by the year 2000. Acting on waste management issues now could help avert serious problems down the line. This problem is not unique to Ontario.

In Metropolitan Toronto tipping fees are currently $100.00/tonne. Since January 1, 1989 all white goods (metal appliances) have been banned from all sites. Since Sept. 1, 1989 all bin loads containing more than 20% by volume of recyclable corrugated cardboard have been banned from all sites.

Wood wastes will be banned as soon as a local recycling facility, capable of handling the quantities generated in Metro Toronto, has been opened.

Wood waste processing has been slow to develop, and markets have been uncertain. There has been some discussion of the possibilities of chipping wood wastes and using the chips as on-site ground cover. Unfortunately decomposing wood requires large amounts of nitrogen; something found with abundance in grass. If chipped wood was used as ground cover, there is a strong possibility that it would kill the sod laid down over it because of the high levels of tannic acids in SPF lumber. Using these chips for surface treatment such as on hiking paths or bike trails is a feasible option.

In the Vancouver area, clean wood is chipped and used by industrial users as a supplement to hog fuel in incinerator/cogeneration units.

In Ontario there is a strong market for wood chips and shavings among horse breeders and racetrack operators.

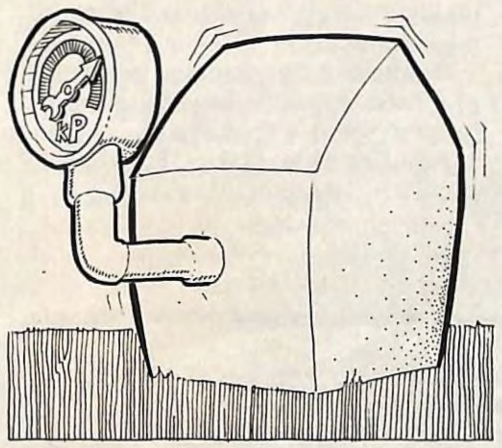
Recommendations currently being considered by Metro Toronto, if implemented, will require builders involved in new developments larger than 25 units to table a detailed plan for managing solid wastes, including reuse and recycling objectives. These plans will have to be approved before the project can proceed.

In Greater Vancouver, waste is being sorted, with recyclable or reusable materials being diverted. Current tipping fees for general waste are $52/ton. Clean pre-sorted waste tipping fees are less.

In smaller more isolated areas all these options may not exist, but a well thought out waste management strategy still is needed.

"Making a Molehill out of Mountain" report prepared for the Toronto Home Builders Association; THBA, 20 Upjohn Rd. North York, Ont. M3B 2V9

Airtightness of new detached Houses



Richard Kadulski

Improved airtightness in houses provides higher comfort levels and reduces:

- energy consumption;
- the potential for moisture damage to the building envelope;
- soil gas entry;
- noise transmission through the building shell.

In 1989 CMHC and EMR sponsored a study of the airtightness of new, merchant builder houses in Canada. The airtightness of 200 new houses was tested using fan doors, depressurizing the houses under three conditions:

1) all intentional openings were sealed (in accordance with the CGSB Standard for Airtightness Testing as used by the R-2000 program)

2) as for (1) but with combustion air supply ducts sealed to measure how much of make-up air was available elsewhere. This simulated the airtightness of the house under a condition where only a make-up air inlet is open.

3) with most openings left unsealed as under normal operating conditions. This represents the normal operating conditions of the house and was done without sealing any openings that normally allow air into the house.

The Airtightness is expressed in air changes per hour (ACH) at a pressure of 50 Pascals (0.4" water gauge). It can also be expressed in terms of Normalized Leakage area (NLA), which is a measure of the total openings in the building envelope.

The R-2000 program places a maximum limit of 0.7 cm^2/m^2 which is the same as saying that the maximum allowable leakage area is about 1 sq. inch for every 100 sq. ft. of surface area of the house.

NLA measurements are a better term for comparison as they are independent of the size of the house, but the study results were quoted in ACH.

The study found that there is a wide variation in the air leakage rates of new houses (Table 1). Airtightness varies from a low of 0.98 to a high of 11.13 ACH. Vancouver houses showed the widest variation (The highest was 11.13 and the lowest 2.86) Saskatoon and Quebec City showed the least variation, the highest air change rate being only 2.1 times the lowest.

Overall, there is no doubt that houses are being built tighter today. Compared to data from a similar study done in 1982/83, new homes built today are about 30% tighter than those built less than a decade ago.

New B.C. houses still tend to be the leakiest. In other areas where houses were already built tightly, the change has not been nearly as dramatic. The greatest improvement appeared to be in B.C., where it would seem that the

TABLE 1
Average Air Change Rates for New Houses

Location	Air Change Rate (@ 50 Pa) Average	Minimum	Maximum
St. John's	3.63	2.70	5.34
Halifax	3.22	1.71	5.96
Fredericton	2.93	1.51	5.34
Quebec City	2.86	1.86	3.83
Montreal	3.30	1.71	5.51
Ottawa	4.06	2.50	5.99
Toronto	3.60	2.47	5.35
Winnipeg	2.08	0.98	3.46
Regina	2.44	1.22	3.88
Saskatoon	2.58	1.79	3.77
Edmonton	3.00	1.35	5.04
Vancouver	6.19	2.86	11.13

average air change rates decreased by almost 40% (from 9.33 to 5.95). However, a direct comparison may not be proper as we understand that the B.C. houses tested in the early 80's may have been smaller than new houses (a good portion were townhouses).

Peter Moffat of Sheltair Scientific in Vancouver, who does much air leakage testing in B.C., estimates that based on his experience, B.C. houses today are only 8% tighter than earlier houses. However, the trend is definitely there - houses are getting tighter.

The airtightness level appears to be generally related to the severity of the climate. Houses in the colder regions of the country tend to be more airtight than those located in the more temperate areas. (The banana belt syndrome is at work here - people in B.C. forget they still heat houses, even though we don't do that much shovelling).

Why is it important to know how airtight houses are?

Houses contain equipment for ventilation and to exhaust combustion by-products. Improper construction techniques or selection of equipment will have a severe impact on indoor air quality and more importantly, the health and saftey of residents.

Concern about the quality of the air inside houses is growing as the understanding of the health and productivity effects of indoor air quality increases. The concentration of air pollutants inside is directly related to the source strengths of the pollutants and the rate at which they are exhausted from the space. Most older buildings rely on wind and temperature driven air leakage to provide ventilation. This approach has poor control and usually creates drafts that occupants try to seal.

Tighter structures also encourage the build up of high moisture levels. Higher humidity levels promote the growth of moulds, some of which are harmful to health. High moisture levels inside the house mean that the water vapour inside will condense on a cold surface. This can be windows and doors or in the structure if there are leakage paths to the outside. Water vapour getting into the walls and roof spaces can lead to premature deterioration of finishes and structural members.

Control of indoor air quality and humidity levels is achieved by exhausting stale air. The cooler exterior air (with less absolute quantities of moisture) brought inside lowers the indoor humidity.

Approximately 10% of new houses built in Canada are equipped with whole-house ventilation systems. The remainder have exhaust fans in bathrooms and kitchens. These exhaust air from pollutant generating areas and rely on air leakage through the building envelope to provide replacement (make-up) air. If the house envelope is airtight (as it should be) the living space will be depressurized unless there is adequate make up air supply.

Depressurization of the house can cause combustion spillage from most naturally aspirating (i.e. units without draft induced or sealed venting of combustion products) fuel fired furnaces, boilers, and hot water heaters. Combustion by-products such as carbon dioxide, oxides of nitrogen, and possibly carbon monoxide are released into the house. Depressurization also increases the chances that soil gases will be drawn into the house.

The amount of the depressurization is proportional to the difference between the rate at which air is exhausted and the rate at which it leaks into the building through cracks and holes in the envelope.

Because of the potential problem, proposed standards are suggesting that in houses with naturally aspirating fuel burning appliances, depressurization should not exceed 5 Pascals.

TABLE 2
Air Flow Needed to Depressurize New Houses to 5 Pa
Air Flow - cfm (*l/s*)

Location	Average	Minimum	Maximum
St. John's	253 *(120.6)*	147 *(70.1)*	415 *(197.6)*
Halifax	229 *(109.2)*	82 *(39.2)*	538 *(256.5)*
Fredericton	218 *(104.0)*	126 *(60.4)*	341 *(162.6)*
Quebec City	130 *(62.3)*	82 *(39.1)*	338 *(161.1)*
Montreal	155 *(74.2)*	66 *(31.7)*	269 *(128.1)*
Ottawa	354 *(168.9)*	187 *(89.4)*	500 *(238.4)*
Toronto	375 *(178.7)*	172 *(81.9)*	663 *(315.8)*
Winnipeg	145 *(69.0)*	64 *(30.5)*	328 *(156.4)*
Regina	186 *(89.0)*	86 *(41.2)*	277 *(131.9)*
Saskatoon	215 *(102.7)*	135 *(64.7)*	297 *(141.6)*
Edmonton	250 *(119.0)*	129 *(61.3)*	447 *(212.9)*
Vancouver	464 *(221.3)*	205 *(97.5)*	711 *(338.5)*

What can generate 5 Pascals of depressurization?

Most new houses contain at least a clothes dryer and a bathroom or kitchen fan. These devices, operating at the same time can provide an air flow of at least 230 cfm (113 L/s).

A clothes dryer, a bathroom fan, and a kitchen rangehood drawing 230 cfm, can generate a depressurization of at least 5 Pa in the average new house in seven out of 12 cities (Quebec City, Winnipeg, Montreal, Regina, Saskatoon, Halifax, and Fredericton).

Much of the low cost ventilation equipment used in most houses does not perform as its supposed to (it is not suitable for continuous use because it is too noisy and is not durable). In spite of the poor performance of cheap fans, 18% of new houses will depressurize to more than the 5 Pascal limit recommended for naturally aspirated combustion appliances. 20% of new houses will be depressurized by more than 10 Pa by the average dryer, bathroom plus kitchen fan.

Table 2 shows the average, minimum and maximum airflows required to create a pressure difference of 5 Pascals in typical new houses.

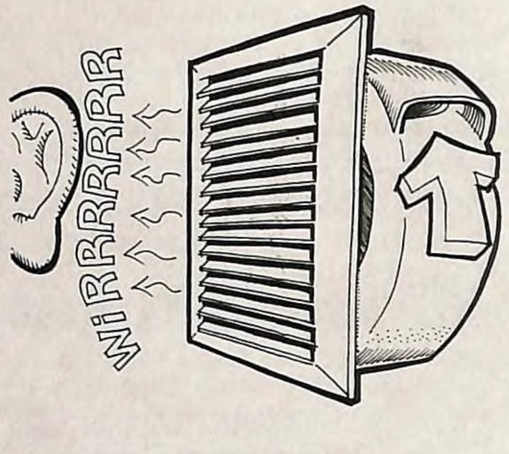
With today's busy lifestyles, it is not out of line to suggest that most fans will run at the same time, as people come home from work, one takes a shower, supper is cooked, and a load of laundry is done (or it may be in the morning as everyone is rushing to get out of the house).

The moral of the story? New houses are being built tighter. When designing and equipping the house, it must be remembered that the house works as a whole system. When selecting exhaust equipment it is important to consider how it relates to all the other equipment in the house.

This item is based on work by Tom Hamlin, Michael Lubun and John Forman reported on in an as yet unpublished draft report.

Ventilation Case Study: the importance of noise levels

Richard Kadulski



Regular readers will know I have written much about energy efficiency and ventilation issues. Many probably believe I live in a state-of-the-art energy efficient home. It may dismay some that home is really a modest 1 bedroom 650 sq.ft. mid 70's vintage spec built condo apartment (that's taken a lot of effort to repair construction faults!).

At long last, I have installed a central ventilation system: an AERECO humidity controlled ventilation system (Solplan Review No. 11 Oct-Nov 1986). It has a central fan with exhaust ports in the kitchen area and bathroom. Humidity controlled fresh air inlets are located in the bedroom and living area.

The unit continuously draws about 44 cfm (18 cfm from the bathroom, 26 from kitchen) to maintain a 50% relative humidity. The system places the apartment under a small negative pressure (approx 0.006" WG or 1½ Pascals). Until we weather-stripped the door, this was enough to draw in smells from the unpressurized hallway.

The apartment is a corner unit so that in theory "cross ventilation" is available. Was there any point in going to this great length? I can verify that "cross ventilation" doesn't work all the time, especially when you need it most! During the winter it's too cold to open the windows, in the spring and fall leaving windows open all day has no effect (assuming security was not a consideration).

The smell of fried onions or other cooking odours or the aroma of smelly socks left on the floor would linger even if a window or two was left open. In other words, despite the best intentions the apartment could generally have been described as being stuffy. The continuously operating ventilation system has resolved the problem of lingering odours; the apartment is no longer stuffy.

However, the installation underlined the importance of paying attention to the noise levels generated by continuously operating mechanical equipment. Today's younger generation, by the time they reach their late teens has often suffered hearing loss after time spent in rock concerts, in loud night clubs or under Walkman earphones and may not appreciate quiet.

But for someone who appreciates quiet, or at least being able to control their auditory environment, and has good hearing, the control of noise and the elimination of irritating back-

TABLE A
Measured noise levels

background level	30 dB
Refrigerator[1]	39 dB
Microwave[1]	58 dB
Plumbing noises[2]	41 dB
Central ventilation system when first installed[3]	33 dB
soft whisper at 6 feet	35 dB
background level (in a quiet office)	35 - 40 dB

[1] from 3 feet away

[2] building plumbing noises from a common wall

[3] about 12 feet away from the exhaust

ground noises is important and healthy. This means that a good ventilation system has to be quiet. But how quiet is quiet? The B.C. Building Code now requires fans to be rated for lass than 2.5 sones or 60 decibels. That is too loud for continuous operation.

We did measurements of noise levels in the apartment before and after installation. The background noise level is 30 dB.

Table A shows sound levels generated by household appliances and by the ventilation system. Appliance noises are generally tolerated as they are intermittent.

Noise generated by the central ventilation system when first installed registered 33 dB in the living area (about 12 feet away from the exhaust). 33 dB is quiet, right? At home, it is surprising how irritating even such a low level is. While it may be tolerable in many situations it was too loud for comfort. The supplier was able to provide an alternate model of the exhaust port that reduced the noise by 3 dB.

Advanced House a reality

The Advanced House demonstrates new products and technologies that can reduce total home energy use without compromising comfort and safety.

The Advanced House uses products that are at the leading edge of technology; most are already commercially available. It is designed to use one quarter the energy of a conventionally-built home.

Energy efficiency is important because global warming and many of the other environmental problems we face is caused largely by our misuse of energy. It is a small step towards environmentally responsible housing.

Features include:

* High-performance energy-efficient windows: triple-glazed, double low-E with gas fill, and insulating edge spacers (R-5.2). These units are now commercially available.

* Integrated mechanical system: a single piece of equipment replaces the furnace, the hot water tank, the air conditioner and the ventilation system. The efficient unit provides 60% energy savings over conventional equipment.

* Energy-efficient appliances: the appliances demonstrated in the house use between 20% and 60% of the energy of average appliances.

* Energy Efficient lighting: efficient fluorescent lights that are attractive, practical and use 80% less energy.

* High levels of insulation: R-40 (RSI 7) walls, R-60 (RSI 10.6) ceilings and R-37 (RSI 6.55) basement drastically reduce space heating and cooling energy use. Environmentally friendly cellulose insulation was used. A blown in batt was used in the walls.

* Airtight construction: as in R-2000 construction, a continuous air barrier prevents air leakage and protects the building fabric. Fresh air is continuously distributed to each room.

* Two-storey passive-solar sunspace: is a solar collector that collects and stores solar heat for the rest of the house and preheats the ventilation air.

* Energy-efficient fireplace: most fireplaces waste energy and contribute to air pollution. The efficient prefab contraflow fireplace reduces emissions and stores heat.

* Energy-monitoring: a two-year testing and monitoring program will verify whether the house and its components perform as expected.

What about costs?

The house was built by the Fram Building group's regular sub trades, who did not break out all the incremental costs. As well, because of the high profile of this project many suppliers contributed materials so hard costs were not established. Elizabeth White, the project manager, estimates that a realistic value for the incremental costs of achieving this level of construction, for this type of design could be in the range of $20,000.

The Advanced House is a cooperative project involving the Ontario Ministry of Energy, Energy Mines Resources Canada, Ontario Hydro, and the Fram Group.

The Advanced House is located in Metropolitan Toronto (corner of Vodden and Laurelcrest streets, north of Highway 7, west of Dixie Rd. in Brampton, Ontario). The house will be open for public and industry tours until February 1991. 12:00 noon - 6:00 p.m., Wednesday, Thursday and Friday; 10:00 a.m. - 4:00 p.m. Saturday and Sunday. For tours or information phone (416) 450-6713

Construction Practices: 'Pulse' builder survey results

Richard Kadulski

Energy Efficiency and Air Quality awareness is increasing among new home buyers

Home buyers have become more aware of the importance of energy efficiency in recent years. Over half the builders surveyed across Canada indicated that buyers are more aware of energy efficiency issues now than they were a year ago - almost 90% are more aware than five years ago.

Consumer awareness of ventilation and air quality issues has also increased significantly. Over half the builders indicated that buyers are more aware of these issues than they were a year ago; over three quarters are more aware than five years ago. There were no significant regional differences in increased public awareness of either energy efficiency or air quality.

Builders are responding. Almost half indicated that someone in their firm had attended an R-2000 training seminar (but there's still the other half that haven't!). The lowest attendance was in Quebec (29%) and Ontario (51%). In other provinces it was 64 - 100% of respondents. Of those who took an R2000 course, 70% indicated that they had changed the way they build houses as a result of the training.

The impact of R-2000

The R-2000 program has encouraged changes in construction practices. The spread of R-2000 technology is reflected in the use of higher insulation levels than are called for by codes or that is normal practice, sealing of joints, and attention to air and vapour retarders as well as air tight drywall techniques combined with mechanical ventilation systems.

Of the builders who changed the way they build houses as a result of R-2000 training, virtually all now build tighter houses than in the past. Increased insulation and mechanical ventilation were other significant changes as a result of the R-2000 course.

Over three quarters of all builders include above-code insulation in ceilings, attics and walls; two thirds use more insulation in basements.

Many builders have adopted other techniques to improve the quality of new housing. Acoustical sealing of vapour barrier joints, sealing of penetrations and electrical boxes, the use of air barriers and the "air tight drywall" approach all were used mostly or all the time by more than half the builders. In addition, almost 90% of these builders indicated that they now placed a greater emphasis on "quality" in their advertising.

Common building techniques

Framing

B.C: Standard 2x4 framing is still common. Sometimes 2x4 with insulated sheathing is used. 2x6 framing is used by about 1/3 of builders surveyed.

Prairies: Reflecting a harsher climate, most builders use 2x6 framing, occasionally with insulated sheathing. Double wall construction is sometimes used in Saskatchewan and Manitoba by a small minority of builders.

Ontario: A surprisingly large number (over 1/3) still use 2x4 framing always or mostly. (In Toronto, most construction is 2x4). A smaller proportion use 2x6 or 2x6 with insulated sheathing.

Quebec: 2x6 or 2x6 with insulated sheathing is used mostly. A small portion (less than 10%) build with 2x4.

Atlantic: Virtually everyone builds with 2x6 or 2x6 with insulated sheathing.

Insulation

Above code levels of insulation for walls, ceiling and basement are used in all areas. Only in Saskatchewan are basements not insulated over code. (However, what standard insulation levels are is not stated). The National Building Code does not set out insulation standards, but some local jurisdictions do. Reference to code insulation levels would more likely be to the conventional practice in each region.

Airtight Construction Practices

Most builders in all regions use 6 mil poly for airtightness, with acoustical sealant on joints.

The airtight drywall approach (ADA) is not yet regularly used in all areas. In B.C. 54% never use it, 32% sometimes, only 13% always or mostly. In Alberta 68% never use it, only 24% always or mostly. (Yet Alberta has financed much research, development and monitoring of ADA). In Saskatchewan 53% use ADA always or mostly; in Manitoba 31% always use ADA, 69% never; in Ontario 55% never use it, 32% always or sometimes. Quebec has the highest penetration of ADA users with 59% always or sometimes using ADA. New Brunswick and Nova Scotia have a fairly even distribution between those who use it and those who never use it.

These results are interesting as they seem to be at odds with your editor's perceptions. They may also reflect on the attitudes that building inspectors take, as not all accept ADA readily. Recently in B.C. there has been an upsurge in interest in ADA as an alternative to the code requirement for 6 mil poly.

Testing For Airtightness

Only in Quebec, New Brunswick and Nova Scotia do a significant portion of builders test houses for air tightness.

Windows

Double glazed windows are the norm in all parts of the country. Triple glazed windows are standard in many Manitoba and Saskatchewan homes. In other areas it's an option. Low-e or Low-e with gas fill is an option for many, although over 1/3 do not offer this as a option.

Furnaces and Water heaters

Only ¼ of builders offer higher efficiency furnaces and water heaters as standard - most offer them as options. Heat pumps are offered as options by most.

Ventilation:

(Heat recovery ventilators)

Most builders in Atlantic Canada offer HRV's in their base price. In Quebec 65% offer HRV's as an option (but 16% don't offer them). In Ontario, only 6% offer HRV's while 40% offer them as an option, but the majority (54%) do not offer HRV's at all.

On the prairies the majority offer HRV's as options, but 39% in Alberta and 30% in Manitoba do not offer them at all. In B.C. 26% include HRV's in the base price, for 62% it's an option, and 12% do not offer them.

The 6th **Pulse** *survey of the building industry was sponsored by Fiberglas Canada in association with the Canadian Home Builders Association. It was undertaken in January, 1990 across Canada. 583 builders and renovators responded.*

The survey was designed and tabulated by Clayton Research Associates,

Letters to the Editor

Re: Frozen HRV's
(Solplan Review No. 31)

During the past five years I have been responsible for the installation of over 800 Heat Recovery Ventilators in the residential market. As every unit we install is supplied with a "FOR SERVICE CALL" sticker, we receive a call when something goes wrong.

We have experienced some frozen cores over the years and our testing has shown that there are two major reasons for core freeze up.

Occasionally on models with a damper motor, it fails to close off the cold air entering the HRV from outside and allow warm air to defrost ice. The HRV manufacturer cannot really be blamed for this as the damper motors are purchased from outside suppliers and installed in the HRV's. We must note that our current major supplier recognized this "weak link" and has gone to great lengths to have this motor upgraded. We now have many new motors in service without any replacement necessary for the last five very cold months. I congratulate our HRV manufacturer for their efforts. I see this as a major step towards perfection.

Secondly, the major cause for core freeze up is due to the low temperatures that homeowners choose to maintain in the basement even though they have a "damper style" HRV. When the HRV is activated into a defrost cycle, warm house air is drawn into a defrost port and this "warm" air melts any ice on the core. The air needs to be warm to defrost. If homeowners choose not to keep the basement above 60°F there are other measures that can be taken to achieve a proper defrost.

Typically the basements in this area are kept at a temperature of 41-50°F. Our testing shows that there is not enough energy in this air to effectively defrost in a normal defrost mode. A simple modification corrects this.

My experience shows that these problems are not limited to any one particular manufacturer of HRV's. As far as damper motors are concerned, I know of more than one HRV manufacturer that uses the same damper motor for defrost purposes. Therefore, it is unlikely that core freeze up due to damper motor failure could be limited to any one particular HRV manufacturer.

Greg Barber, President
Capital Ventilation Systems Ltd.
Bedford, NS

I read with interest your article about problems with HRV's freezing up and your request for information on this subject. I am a project officer with the Dept. of Public Works in Cambridge Bay, NT (200 miles north of the Arctic Circle on Victoria Island). We have been experiencing terrible problems with lack of fresh air in our newer staff housing and newer buildings in general. As a result we launched a three year program to investigate the practicalities of using HRV's in the arctic. Up to now it has been the general opinion that HRV's don't work in the arctic because they always freeze up.

Our program consists of comparing a plastic heat exchange core HRV with an aluminum HRV core unit. We installed one VanEE 2000 Plus in Cambridge Bay, one Lifebreath 300 DCS in Coppermine and one Lifebreath 195 DCS in Pelly Bay (which has the highest energy costs in North America). After two years of observations and field adjustments we have drawn several conclusions. They are:

1. All units freeze up to some degree by the time they go on defrost cycle. How well they defrost given the same inlet temperature of defrost air supply is a function of how efficient the heat transfer core is. The aluminum core machines have always been able to melt all the ice out of their heat exchange cores in the time allotted for the defrost cycle. The plastic core machines can only melt about 90% of the ice build up. As a result the ice slowly builds up until the heat exchange cores are completely blocked off, which takes about three weeks at -45°C.

2. It is very critical to get warm defrost air. By mounting HRV's close to boiler or furnace rooms and by using a fire damper, we have been able to take defrost air off the ceilings of these rooms as long as they had a fresh air combustion inlet of sufficient size to supply air to the HRV while on defrost as well as sufficient air to all air breathing combustion appliances in that room. On average, +26°C air temperature is sufficient to melt ice out of aluminum core machines in the dead of winter. This arrangement is very nice because as the outside air gets colder the furnaces or boilers come on more often and hence the rooms they are in get warmer. This complements the need for warmer defrost air for the HRV's. This did not defrost the plastic core machine though and eventually we had to add an electric duct heater to the duct leading to the defrost port.

3. Under no circumstances should screens go over the intake air hood on the exterior of the building. Regardless of the size of the mesh, snow always blocked off these screens.

4. Because electricity is expensive up here ($0.70/kwh) we want to make HRV's cost effective as they have a fan running all the time. If the building is being heated hydronically we place a heating coil in the supply air duct coming from the machine going to the building and take advantage of this air distribution system to also distribute heat. As a result the pump on the hydronic boiler doesn't have to come on as often reducing its power consumption.

HRV's work very well up here as long as they have an aluminum core and a good warm source of defrost air. Operating and maintenance costs also have to be considered when calculating their payback because they have noticeably reduced jammed doors and windows due to lower humidity levels. As well, tenants don't open windows as often as they used to for fresh air which also reduces heating costs. If they can be made to work up here then they should work anywhere. If any of your readers are experiencing problems with their machines freezing up it is either because they are using an inefficient model or are not being careful in acquiring warm defrost air.

Mark Haynes
Cambridge Bay, N.W.T.

(Readers should note: Cambridge Bay has a design temp of -45°C and 12,037 Degree days C; Coppermine design temp is -44°C and 10,758 DDC) Ed.

Re: Paint peeling (Solplan Review No. 31)

I have seen many instances in the north where paint peeling is very clearly the result of moisture from inside the building migrating into wall cavities and attics and "blowing" the paint off the siding due to the extreme vapour pressures at -40°C. At what time of year were the field investigations done?

Mike Youso
Whitehorse, YT

The study was done on houses in Cleveland, Ohio, and was conducted during the late winter and early spring.

Re: HRV Equipment Update (Solplan Review No. 29)

We congratulate you on your perseverance in delving through all the manufacturers' literature to compile a standard features list; no easy feat!

You state *"Most manufacturers offer a range of products. Unfortunately, the tendency is to follow the American auto industry marketing model (the one that sells you a car without the wheels, and the option list may include seats, windows, steering wheel, etc.). In other words, you can't get a functioning car off the lot without fighting a list of options".*

You use CES as an example, making the point that *"it may be one way to offer a range of options, but it calls for a knowledgeable supplier to decipher the options and offer specific packages to suit given climatic conditions."*

You bet it takes an informed supplier to decipher the options - we're not selling a straight forward consumer item such a bathroom fan. When it comes to providing good air quality, the selection of equipment is not always straight forward. Variables such as floor area, occupancy, type and level of contaminants and winter temperatures all play an important role in tailoring an HRV to suit occupant needs.

As with a car, it is important to start with a good basic model. On vanEE HRV's the options are designed to tailor the unit to occupant needs and to save them money by not selling features that aren't needed.

Until one basic unit can accommodate all the needs, all the time, under all conditions, options are the only responsible route.

You note that the sale of an HRV calls for a knowledgeable supplier. It is our hope and endeavour that suppliers and installers will continue to expand their knowledge of HRV's to provide consumers with the best suited equipment for their needs. This is the only way that this young industry can grow and prosper, and that heat recovery ventilation systems will be seen as a good viable solution to poor indoor air quality.

Silvia L. Martini
CES Conservation Energy Systems Inc.
Saskatoon, SK.

Re: Superglass

In your February-March 1990 issue there was a brief item describing Southwall's Superglass R-8 window. While it is true that "Superglass" is only available from Hurd in the USA, we at Visionwall Technologies Inc., were the first North American manufacturer to produce an R-8 window. Geilinger AG of Switzerland, who we are associated with, began producing an R-8 window in Europe in 1984.

We imported and installed the Geilinger R-8 window in a University of Alberta test house in 1986; 42 large windows (about 3'x9') for the Alberta Provincial Museum building in 1987; and 450 sq. ft. of R-8 window for a single family residence in Alberta in late 1987.

Our own manufacturing plant was opened in Edmonton in June 1989 and since then we have continued to manufacture our R-8 window system and have installed, or will be installing, our R-8 window system in a number of buildings in Alberta, B.C., Ontario and the Northwest Territories.

We are planning to manufacture a line of residential window units that should be available later this year.

Donald E. Holte, P.Eng., Chairman
Visionwall Technologies Inc.
Edmonton, AB

1989 Innovator of the Year

The CMHC job site Innovator Awards program was established to encourage innovation and to encourage the widespread dissemination of "tricks of the trade". This year the award goes to Henry Hess of Drerup Construction of Carp, Ontario.

The innovation is to use a reverse corner bead for interior corner drywall support.

When a wall is strapped horizontally to provide an unbroken vapour barrier and a cavity for running electrical wires and electrical boxes, vertical wood blocking is required at interior corners to support the drywall. Installing this blocking between the strapping takes time, costs more for labour and material and makes it very difficult to run wiring behind these corners (Fig. 1).

After installing the horizontal strapping, take a common metal corner bead and reverse it, or turn it backwards, and install it vertically into the corner by fastening it to the strapping. Vertical wood blocking between the strapping is no longer required at the interior corners.

This corner bead provides support for screwing the drywall in the corner and leaves a space behind the corner to run wiring without difficulty. (Fig. 2)

It is estimated that the potential cost saving is $ 15.00 per corner.

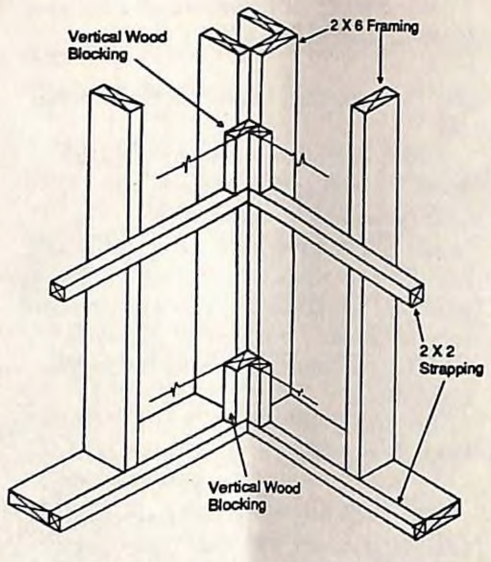


Fig. 1

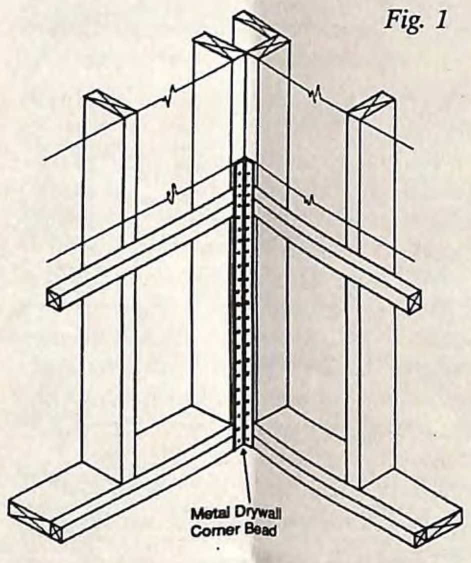


Fig. 2

Round Pegs in square holes (Part 2)

In the last issue of Solplan Review we commented on the problem of sheet metal trades using 4" ducts in 2x4 frame walls (which are 3½" thick). The site compressed duct is oval, but must fit into sheet metal elbows which keep their true round shape. The mismatch creates ideal conditions for loss of airflow if the job is not done carefully and is not sealed properly. One heating and ventilation contractor (feeling guilty?) called to see if I was referring to his job.

More interesting was a call from our friends at **Eneready Products** advising us of a new product they developed to deal with the concerns of 4" ducts and elbows in 3½" wall cavities. It is a one piece 90° plastic elbow (called the "**albo**"). One end is oval to accept ovaled snap lock duct, the other accepts standard 4" duct. The fitting also has fixing tabs to attach it to the framing. The smooth moulded fitting reduces the turbulence of typical sheet metal elbow joints.

For a good installation, all ducts and connections must still be well sealed, but it certainly looks like a good approach to dealing with the fitting problem.

A limited number of prototype units are being made available to installers. A trade price of under $5.00 per unit is being projected.

For information:
Eneready Products Ltd.
5892 Bryant St.,
Burnaby, B.C. V5H 1X6
Tel: 604-433-5697

Gas Fireplace Alert

In Solplan Review No. 30 we reported on a problem with some direct vent gas fireplaces. It seems that the problem is more severe than first thought.

The problem is explosive gas concentrations that can build up in the firebox caused by delayed ignition. If a spark is not generated instantly as designed, the gas may already be flowing into the sealed box and by the time that a spark is generated, conditions are ideal for an explosion, resulting in the shattering of the glass front.

We questioned what the certification standards were for these units. It seems that no standards existed for direct vent units, so other test procedures were ammended which did not foresee this type of problem. The Canadian Gas Association has decertified *all* direct vent gas fireplaces. Existing units already installed will have to be modified in the field as required. At press time, what the retrofit work will be was not known.

European units (such as the **Valor**) which were designed to other stringent standards should be able to comply with any new standards. Until the certification procedures are sorted out, they are also covered by the prohibition order.

Earthquake Design

The October 1989 San Francisco earthquake can be used to assess the seismic risk faced by other earthquake areas, such as Vancouver.

Soil conditions is a major factor in the earthquake. Earthquake forces are amplified on soft soils, as soft, saturated granular soil is transformed to a liquid. When this happens there is a loss of bearing strength which leads to cracks in the ground, heaving, building collapse and differential settlement.

Soil conditions change the properties of earthquake motions that at bedrock. Soft marshy soils (e.g. river deltas) are especially vulnerable as are filled areas, silty clayey sand, sand and gravel.

After the quake a team from the National Research Council of Canada went to San Francisco to study the effects and to see how building codes should be revised. Potential weakness in the 1985 National Building Code of Canada (NBC) were identified in the seismic requirements for Residential Construction (Part 9). These concern lateral bracing, beam splice ties over supports, and anchorage and reinforcing of chimneys.

It is not possible to completely earthquake proof a building, but applying what has been learned about earthquakes can go a long way to reduce the risk of serious structural failure.

Wood frame single-family dwellings, 3-4 storey wood frame apartment houses and 2-storey townhouses suffered heavy damage.

One and two story wood-frame structures are fairly resilient if they are on solid ground, bolted to their foundations and braced to withstand the lateral shear forces that come with a strong tremor.

Many older structures are not bolted properly and few if any are adequately braced. "Cripple" (or "pony") walls failed in many old wood frame houses. These are usually short but in some new houses they could be a full story.

The photos show homes on their knees as the houses were shifted off their foundations during the quake. Bulges low on the siding that mean collapsed cripple walls. Improper bracing and inadequate connection between the foundation and the first floor framing caused them to be moved off their foundations. Although the walls were sheathed or sided with horizontal boards, nailing was less than required by code so they could not provide the resistance to prevent racking. In some cases this led to the complete failure of cripple walls. Large openings collapsed due to lack of lateral resistance and settlement of the foundations.

Modern wood houses (most built to new codes) with and without cripple walls performed well unless they were situated on ground fissures.

The most serious deficiency in Part 9 of the NBC is the lack of requirements for wall bracing in wood frame construction. Ground storeys of 2 or 3 storey buildings with large openings (e.g. double garage doors) may collapse laterally. This could be important in some townhouse and apartment configurations.

Other deficiencies include the need for end tying of beams over supports (some failures happened because beams were not restrained) and anchorage of masonry chimneys to the roof and floors.

collapsed cripple wall and porch

Collapse of foundation walls weak in racking resistance was also serious. This is covered in Part 4 lateral force requirements (4.9.15.1.5 for wood construction and 4.9.4.1.1 for construction not specified in Part 9). People may not be aware of this so there may be a need for a brochure on earthquake resistant construction practices.

Most serious structural failures in residential construction are covered by current code requirements. The main problem is the safety of older buildings with serious deficiencies, especially 3 storey wood frame structures with weak ground storeys on soft ground.

Damage in the Vancouver area may be worse than in San Francisco for a similar sized quake as the design level for earthquake resistance is lower; the requirements for residential construction (NBC Part 9) are less stringent; there are more soft soils in populated areas; the recorded ground motion in the populated areas were less than the design earthquake for Vancouver.

The soft soils in the Vancouver area include the Fraser Delta, the False Creek area, and other areas of man made fills are likely to cause major damage in an earthquake.

Earthquake considerations are not confined to the West coast area only. Large populated portions along the St. Lawrence River are also subject to earthquake activity.

Environmental Choice: Construction products

You want to use products that are not going to destroy the environment. But what qualifies? To make it easier to select environmentally friendly products, the Canadian government has established a voluntary product labelling program administered by the Canadian Standards Association, known as **Environmental Choice**. Products meeting standards can carry the program logo "Ecologo".

What qualifies a product for the Environmental Choice?

Anything made, used or disposed of in a way that causes less harm to the environment than other similar products. A product may be certified because it is made in a way that improves energy-efficiency, reduces hazardous by-products, uses recycled materials, or because the product itself can be reused, or is in some way environmentally sensitive.

Are EcoLogo Products really "Environmentally Friendly"?

Few products have no negative impact. Certified products help reduce the burden on the environment.

During the recent **Globe '90** conference in Vancouver, the first products certified to carry the logo were announced. Products of interest to the construction industry are:

* **Cellulose insulation**: To qualify, the fibre content of cellulose insulation must be 100% recycled and must not contain ingredients which would require it to be labelled as poisonous, corrosive, flammable or explosive. Products by **Can-Cell** and **Fibrex** qualify.

* **Paints** contain solvents known as volatile organic compounds (VOCs), metals, organic dyes and fungicide. All can be toxic to humans, plants and animals.

The interaction of sunlight with VOCs can form ozone and other pollutants which create "photochemical smog" in the lower atmosphere. Disposal of paints also presents an environmental problem. Prolonged or repeated exposure to these can cause severe health problems.

Water-based paints to qualifying for the EcoLogo must not be made with formaldehyde, halogenated solvents or aromatic hydrocarbons; contain no mercury or mercury compounds, or be tinted with pigments of lead, cadmium, chrome VI or their oxides. They must have a flash point of 61°C or greater, and must not contain VOCs in excess of 250 grams per litre excluding water.

Some products made by **Benjamin-Moore, International Paints,** and **ICI** qualify.

* **Heat Recovery Ventilators** to qualify for the EcoLogo certificate must recover 75% of the heat contained in the outgoing air at 0°C, plus they must have a minimum exhaust air transfer ratio of 5%, when tested according to the CSA standard.

At press time no HRV product had been certified.

Canadian Home Builders' Association

TRC News

Research Activities

The main concerns of the Technical Research Committee have been dominated by drywall discolouration concerns, ventilation and air quality, and framing lumber moisture problems. Studies presently underway include:

- **Drywall Discolouration:** a detailed scientific study is being undertaken to get at the root of the problem.
- **Ventilation:** a series of studies are underway to assess the impact of the proposed CSA ventilation standard on housing, to develop simplified strategies to meet the CSA standard, including a how-to manual.
- **Moisture studies:** investigating the moisture content in construction and its drying capacity.
- **Earthquake study:** work is underway to determine needed changes to codes and to assist authorities prepare for emergencies in the event of quakes.
- **Airtightness testing:** work to investigate the situation in current housing and its implications on indoor conditions, ventilation, combustion appliance venting and code impacts.
- **Residential Fire Sprinklers:** a detailed study assessing the cost effectiveness of sprinkler systems is being finalized. The analysis demonstrates a net cost benefit to the country by installing smoke alarms rather than sprinklers.

The Research and Development Subcommittee is seeking comment on other directions research should be pursued. Anyone who wishes more information on any of the projects underway; has suggestions for investigations that need to be pursued; or has any other comments should contact:

Technical Research Committee
c/o CHBA National Office
200 Elgin St. Suite 502
Ottawa, Ont. K2P 1L5

Housing Quality Consultations

The TRC presented the CHBA Housing Quality position paper to the House of Commons Standing Committee on Science and Technology on March 29, 1990. The paper is intended to register consensus among the players in the housing industry on a definition of housing quality and how improvements can best be handled.

One of the key points being made is the need to minimize the duplication of research funded by the government and its agencies.

The presentation was made by Willis Graham, TRC Chairman, along with Bruce Clemmensen, Bob Sloat and John Kenward.

Builder concerns across Canada

The TRC monitors concerns that are discussed at the provincial technical committees. Where appropriate there is follow up at the national level, where greater resources may be available or if a national pattern becomes evident.

Some of the issues that were presented at the February meeting of the TRC by provincial representatives are summarized here.

Yukon: Indoor air quality study is underway; a Northern Building Science Centre is under construction.

B.C. Moisture problems in heated crawl spaces (common on the coast) are to be studied. The code is ambiguous on ventilation requirements, which results in uneven interpretations. A technical lending library (including videos) is getting strong interest. A catalogue of specialized R2000 product literature is being developed.

Alberta: Builders are experiencing the swelling of subfloor underlayment. Proposed changes to span tables for Douglas Fir lumber are being reviewed as they will have a serious impact on construction.

Saskatchewan: Flooring problems are a major issue. The main points are: swelling, squeaking floors, thinness of underlay, and transfer of joint lines through the finish. A study is underway to document the problems being encountered and will try to find a solution.

Manitoba: The 1990 edition of the National Building Code is expected to be adopted by mid-year. Radon and ventilation issues are the key changes. The Home Builders Assoc is planning code interpretation workshops.

After a long battle with Winnipeg about the need for sump pumps in new construction, an independent study was contracted to determine the need for them as a way of dealing with extraneous flows or to recommend alternatives. Despite problems, sump pits/pumps were found to be the most cost effective means of handling these flows.

Ontario: Proposed Code changes will add to costs in four main areas: requirements for mechanical ventilation, upgraded insulation standards (especially full height basement insulation), radon abatement, and requirements for resistance to forced entry. OHBA is pushing for research on basements in general, and foundation wall insulation in particular.

Quebec: A quality and performance standards manual for use by builders and conciliators of the Warranty program to settle complaints is being prepared. A training course on soils identification and how to deal with them is being planned.

New Brunswick: concerns include 1990 Building Code interpretation and training, and new provincial clean water standards (which also cover septic tanks).

Nova Scotia: Quality assurance is a concern: especially availability of trained technicians for air leakage testing. There is a concern for quality of attic insulation installations (especially of glass fibre blowing wool).

They are also looking for: 4"x6" bearing plates for jack posts and four ply built up beams; also anchor bolts with an extra ½" of threads so sill plates can be bolted without having to notch plates.

Prince Edward Island: Regular meetings have been good for information exchange, but few problems have been raised. New funding is being sought to continue the R2000 program.

HOT 2000

WHAT IS IT?

HOT2000 is an advanced approach to the design and modelling of energy efficient structures.

HOT2000 is an easy-to-use computer program designed to assist builders, architects and engineers design low-rise residential buildings. Utilizing current heat loss/gain and system performance models, the program aids in the simulation and design of buildings for thermal effectiveness, passive solar heating and the operation and performance of heating and cooling systems.

WHAT CAN IT DO FOR ME?

HOT2000 lets you input comprehensive data on proposed building design, analyze the expected heat loss/gain, and revise and test altered designed until a satisfactory design is achieved.

Contains extensive weather data, several models for HRV, foundation, water heating systems, and more.

HOW TO GET HOT2000

HOT2000 is available from the Canadian Home Builders Association (CHBA) in either a Canadian or U.S. version at the following prices:

- $120.00 (Cdn) for the Canadian version
- $150.00 (US) for the USA Version (contains US weather data)
- Price includes User and Reference Manuals

To order HOT2000, complete the attached form and send it with a cheque or money order to:

HOT2000 Sales
CHBA
Suite 702, 200 Elgin St.
Ottawa, Ont. K2P 1L5
Tel: (613) 230-3060

ORDER FORM

Please send me
_____ copies of HOT2000 Canadian Version ($120.00 Cdn) per copy
_____ copies of HOT2000 USA Version ($150.00 US) per copy
IBM Mac

My cheque money order in the amount of _____ is enclosed. Make cheque Payable to Canadian Home Builders' Association

Name _____
Organization _____
Street Address _____
City, Prov/state _____
Postal/Zip code _____
Telephone No. _____

Re-refined motor oil is used motor oil that has been cleaned and restored to a condition that is as reliable as new oil. (Canadians dump 300 million litres of used motor oil: that's over seven times the amount of oil spilled off Alaska by the Exxon Valdez).

Shouldn't you start to use re-refined oil?

All petroleum-based lubricating oils that contain over 50% by volume re-refined oil and less than five parts per million (ppm) of chlorinated compounds can qualify for the **EcoLogo**. Look for the symbol when you purchase oil next. Some **Mohawk** and **Breslube** oil products qualify.